

What is Claimed Is:

1. A magnetic recording medium, characterized in that in the magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, the proportion of functional groups per 100 carbon atoms in a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film exceeds 20%.

2. The magnetic recording medium according to claim 1, wherein a lubricating film of perfluoroether having at least one functional group is provided on the protective coating.

3. A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, characterized in that when a protective film mainly composed of carbon for protecting the magnetic film is formed by an ion beam method or a chemical vapor deposition method, at least one gas among CO_2 , NO_2 , N_2O is added.

4. The manufacturing method for a magnetic recording medium according to claim 3, wherein the protective coating is diamond-like carbon.

5. The manufacturing method for a magnetic recording medium according to claim 3, wherein when the protective coating is formed by the ion beam method or the chemical vapor deposition method, at least one of

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N₂, Ne, Ar, Kr, Xe and hydrocarbon gas or hydrocarbon gas is used.

6. A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, characterized in that when a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film is formed by an ion beam method or a chemical vapor deposition method, at least one gas among CO₂, NO₂, N₂O is added.

7. A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film, a protective coating mainly composed of carbon for protecting the magnetic film and a lubricating film of perfluoroether having at least one functional group on a non-magnetic substrate, characterized in that when the protective coating is formed by an ion beam method or a chemical vapor deposition method using at least one of N₂, Ne, Ar, Kr, Xe and hydrocarbon gas or hydrocarbon gas, at least one gas among CO₂, NO₂, N₂O is added. A magnetic

8. A magnetic storage apparatus, comprising a magnetic recording medium that in the magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, a proportion of functional groups per 100 carbon atoms in a diamond-like carbon protective coating

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- mainly composed of carbon for protecting the magnetic film exceeds 20%; and a lubricating film of perfluoroether having at least one functional group provided on the protective coating,
- 5 a driving part for driving the magnetic recording medium,
- a magnetic head having a recording part and a reproducing part,
- a recording reproducing signal processing part for giving and receiving a signal to and from the magnetic head, and a magnetoresistive head as the reproducing part of the magnetic head.

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